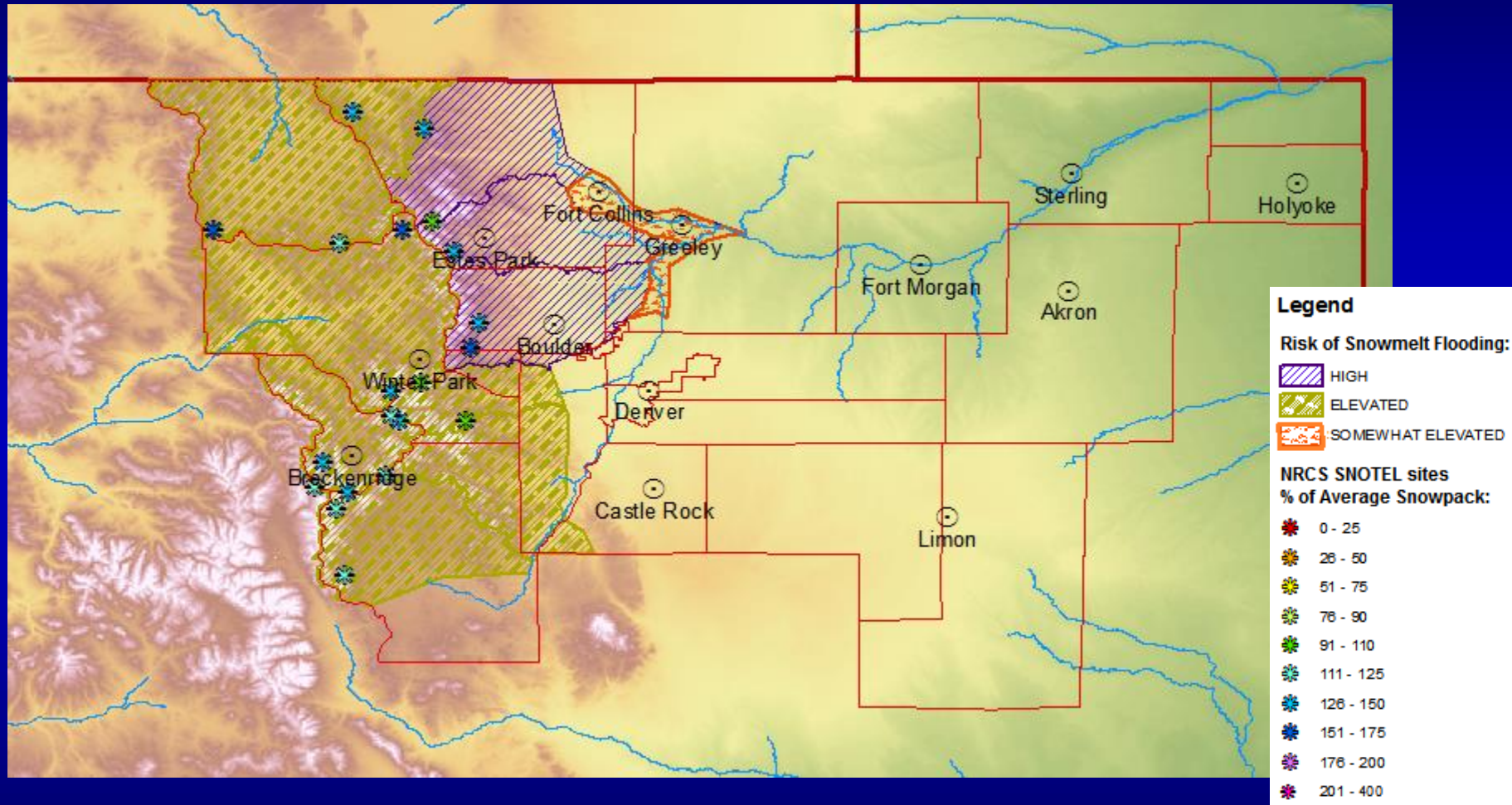


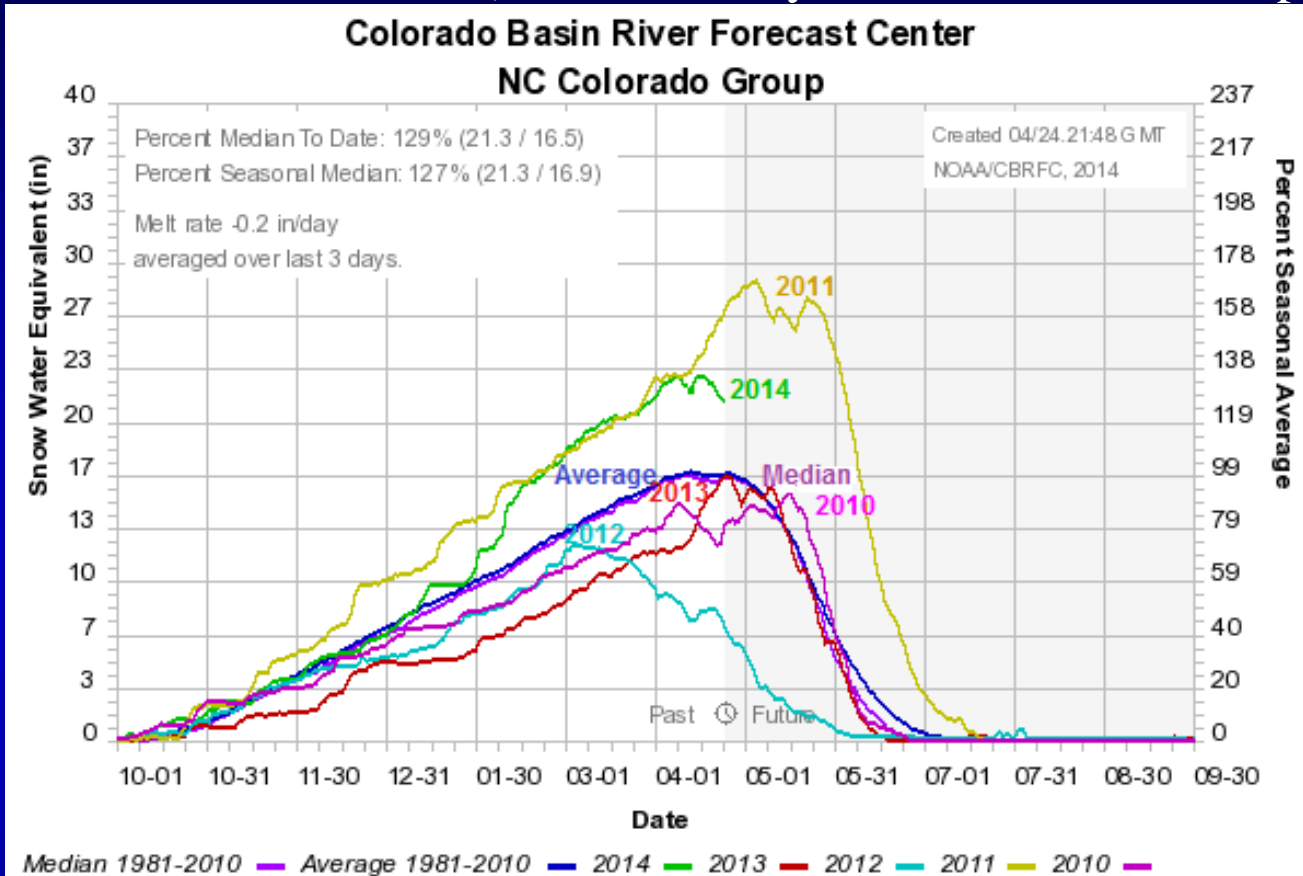
Spring Snowmelt Flood Potential



Spring Snowmelt Flood Potential North Central & Northeast Colorado

- The potential for flooding remains high compared with the spring of 2012 & 2013 in the Saint Vrain (including Boulder) Creek, Big Thompson River and the upper Cache La Poudre River drainages due to the above average snowpack and floods last September.
- The risk of spring snowmelt flooding is elevated elsewhere in the north central mountains and northern Colorado Front Range due to the above average snowpack.
- The flood risk is somewhat elevated in southwest Weld County, and also along lower Cache La Poudre River in eastern Larimer and western Weld Counties due to flooding last September.
- There is a near normal spring flood risk elsewhere on the northeast plains, and the urban corridor from Broomfield County southward.

Mountain Snowpack Timeseries Graph through April 24th, 2014 (each line is a year of mountain snowpack)



- Although the snowpack across North Central Colorado remains well above average, the snowpack has leveled off during April 2014 and was slowly on the decrease.

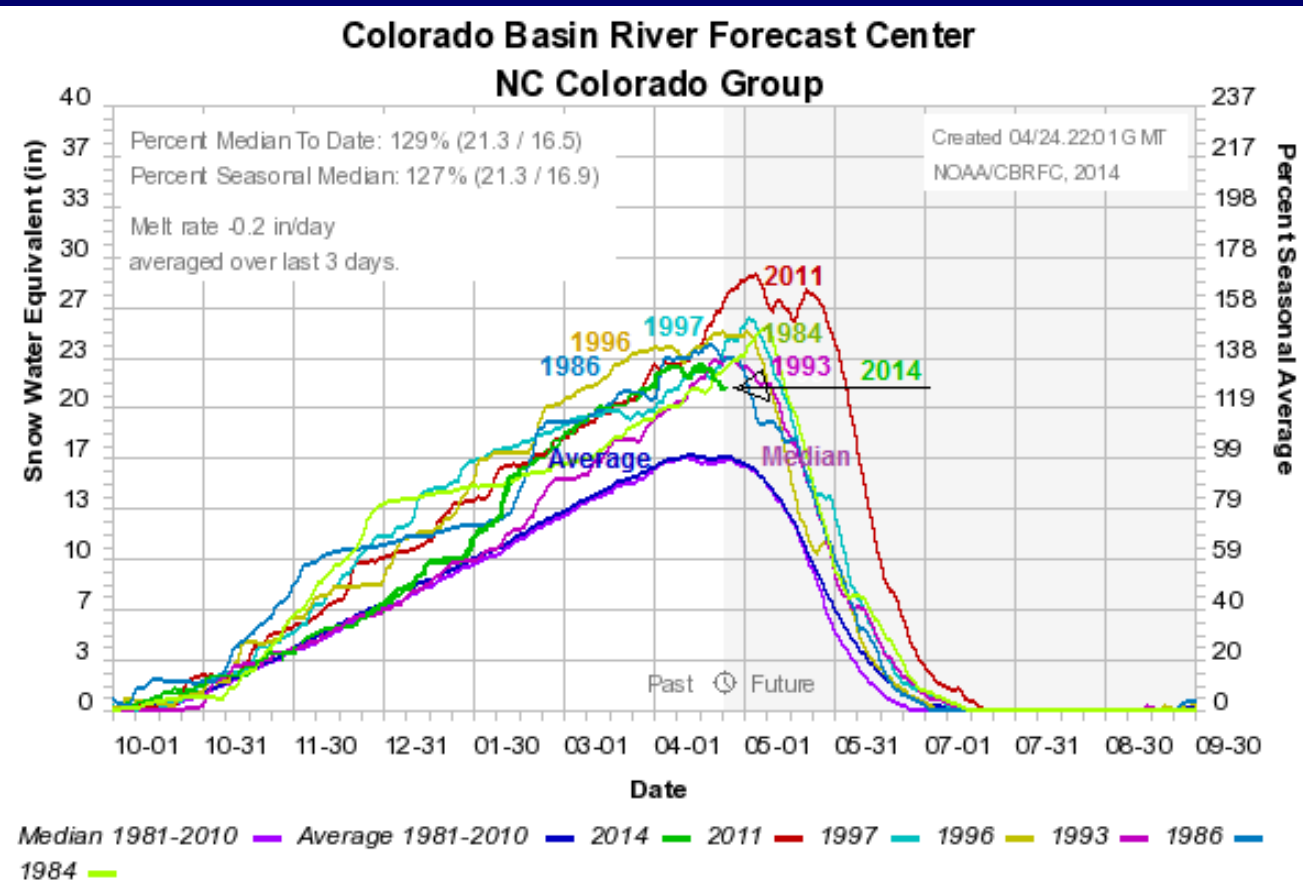
* SNOTEL data for this graph provided by the NRCS.

Additional time series graphs can be produced on the Colorado Basin RFC website at: <http://www.cbrfc.noaa.gov/station/sweplot/snowgroup.php>

NRCS Time Series Snowpack Graphs are available at:
<http://www.nrcs.usda.gov/.../detail/co/snow/products/...> (past 3 years) and
<http://www.nrcs.usda.gov/.../detail/co/snow/products/...> (high/low snowpack years). p

Mountain Snowpack Timeseries Graph

(7 of the highest % of average snowpack years)

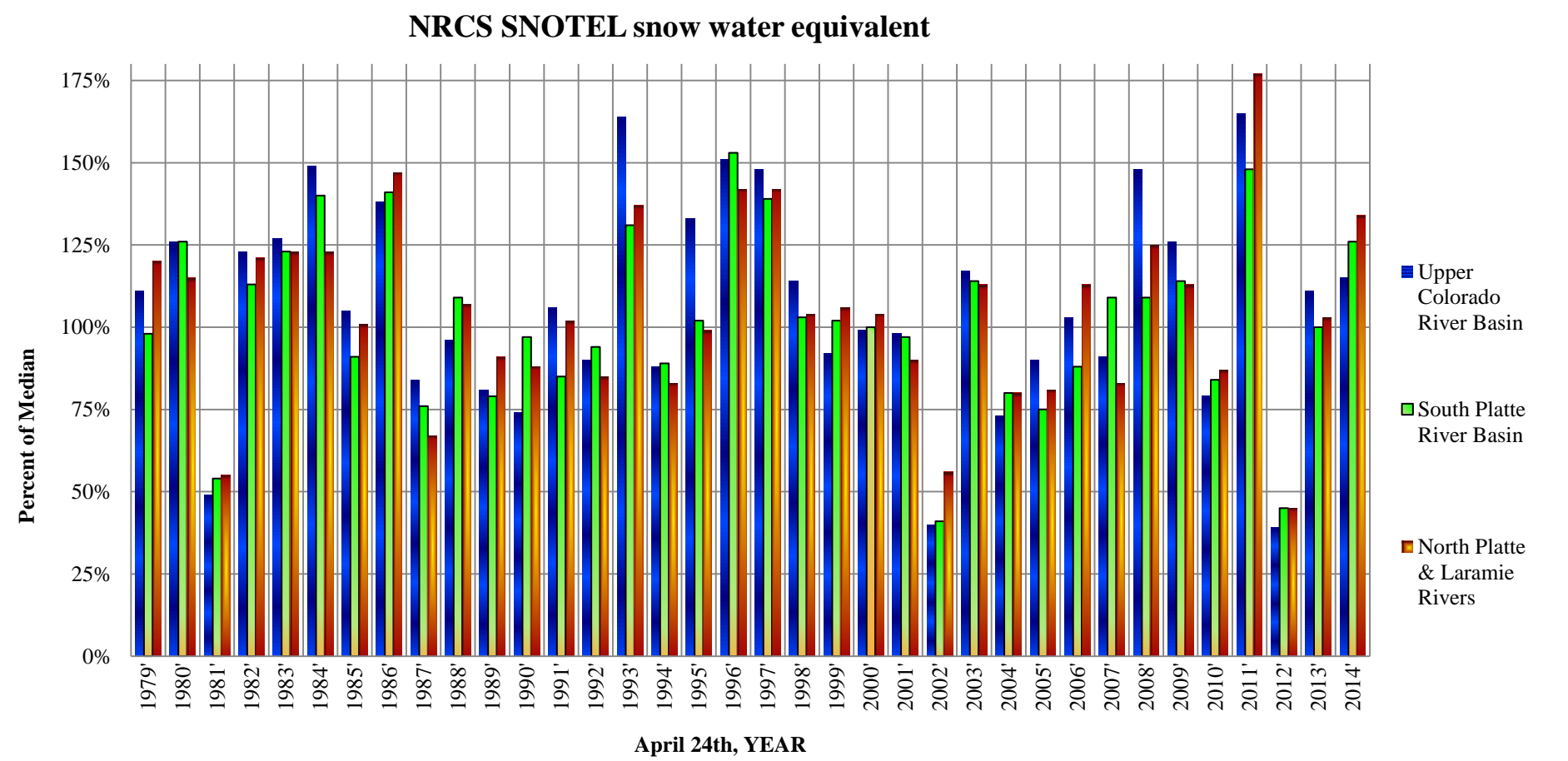


During some other high snowpack years (i.e. 1984, 1997 and 2011), the snowpack continued to increase through April.

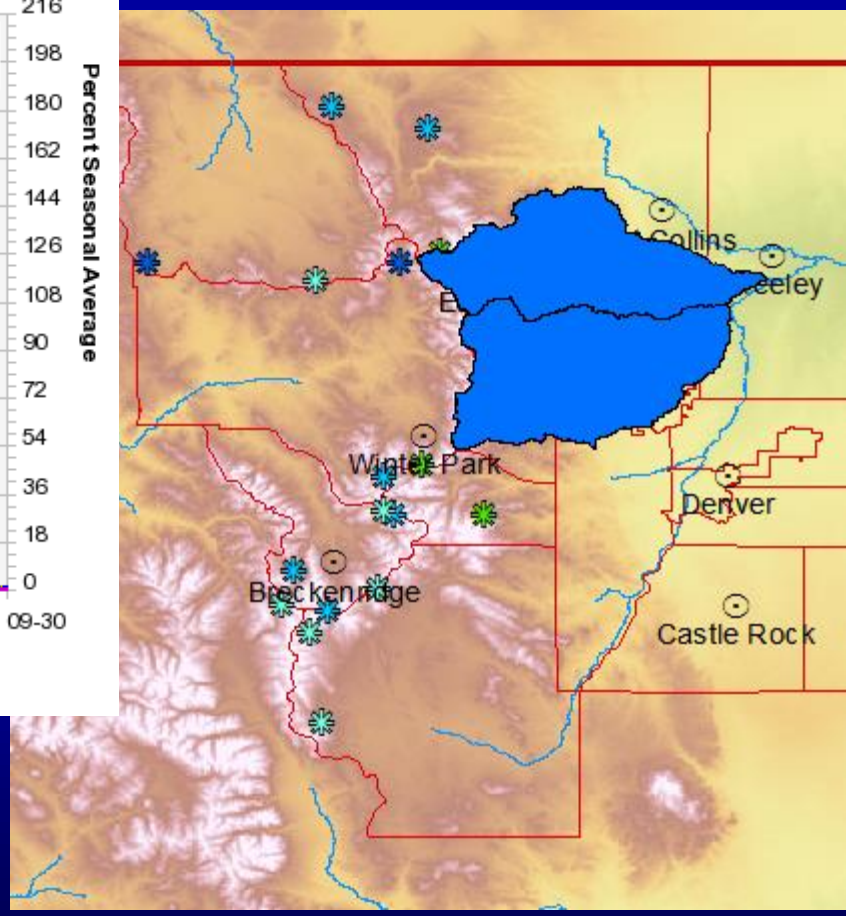
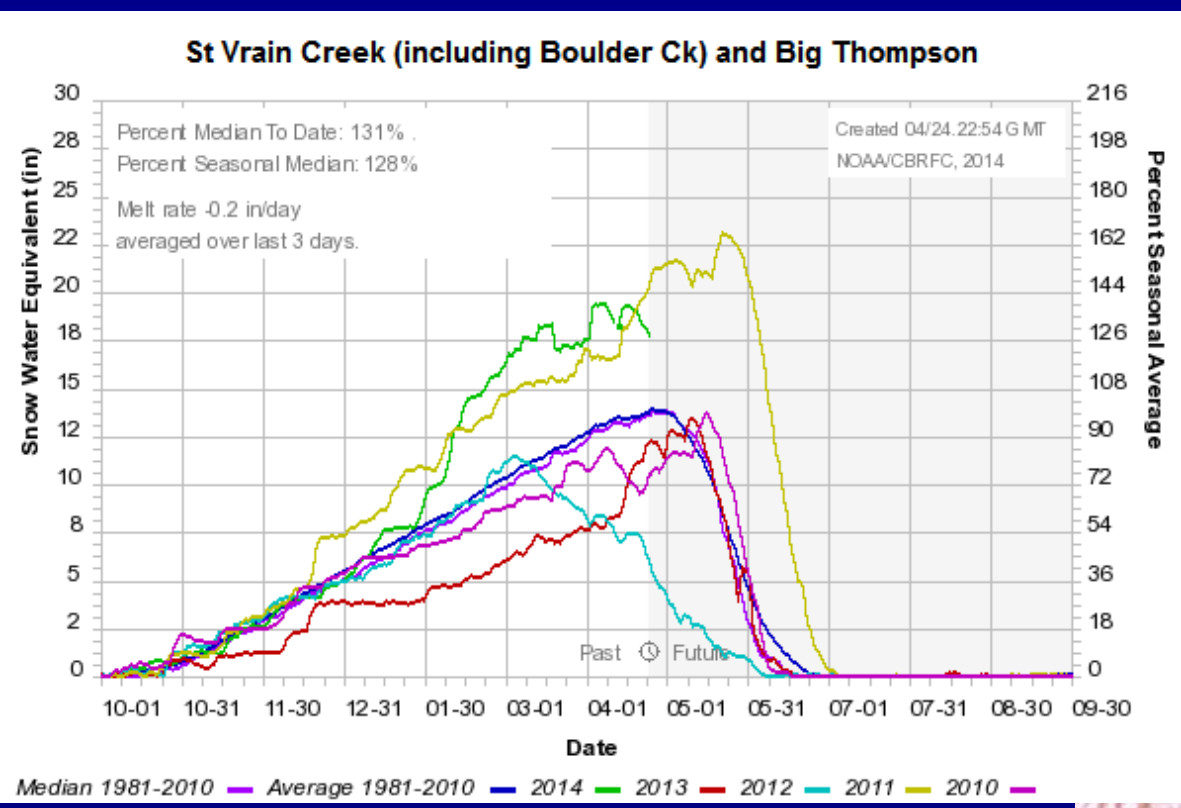
The April 24th, 2014 snowpack in the north central Colorado mountains was roughly 129% of the typical seasonal peak.

* SNOTEL data for this graph provided by the NRCS.

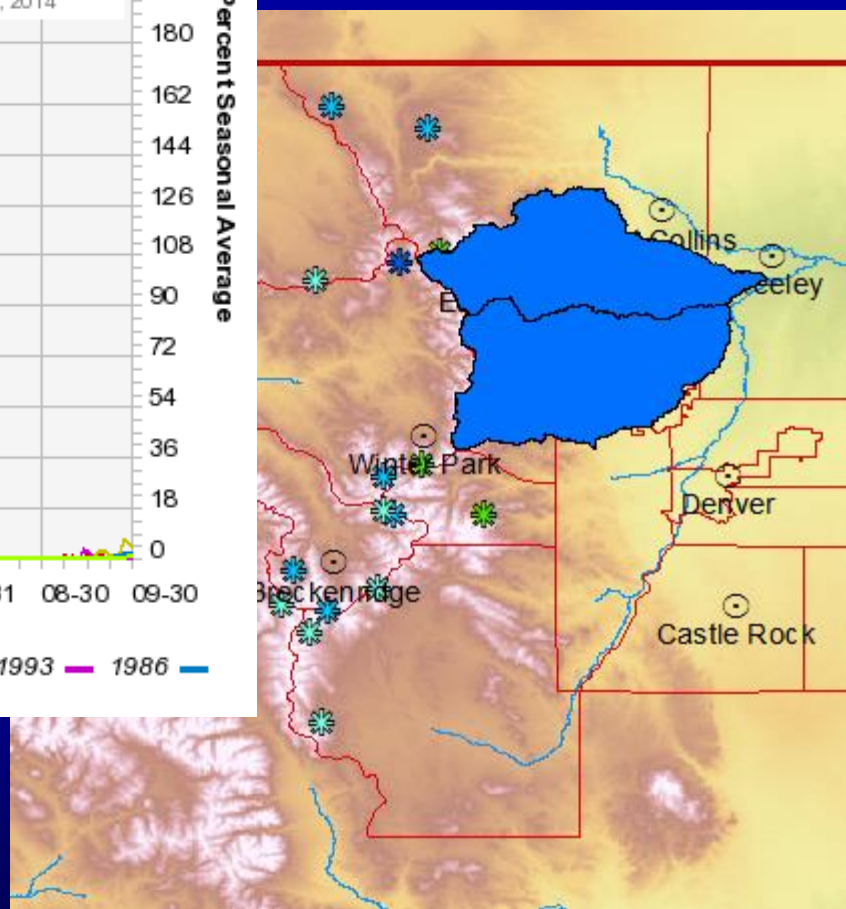
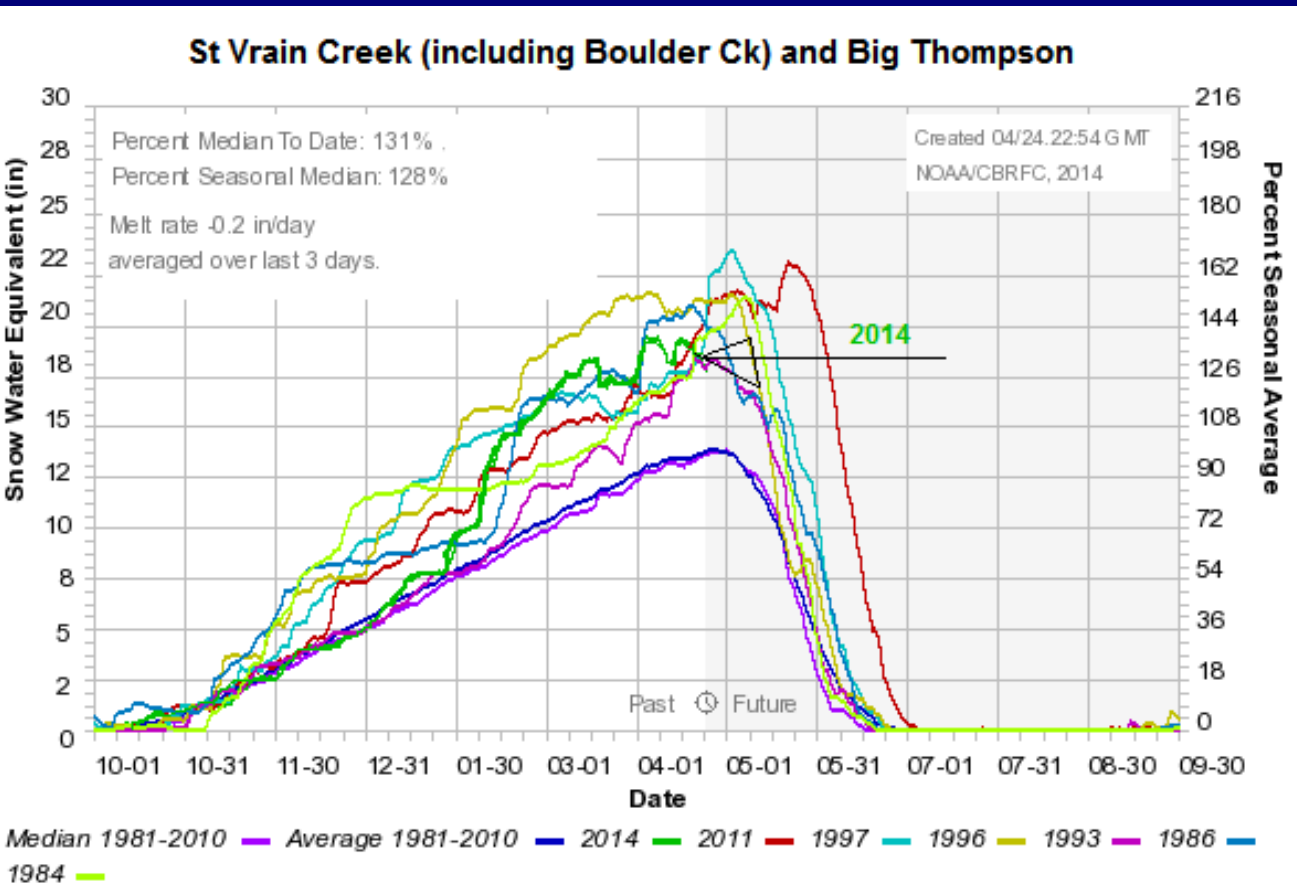
In the South Platte River Basin, the April 24th, 2014 mountain snowpack was in the highest 20% to 25% April 24th snowpacks since 1980. The 2014 snowpack in the Upper Colorado River Basin was in the highest 40% April 24th snowpacks during the past 35 years.



- The green line on the time series graph shows the NRCS SNOTEL SWE (snow water equivalent in the snowpack) from October 2013 through late April 2014 in the Big Thompson and St. Vrain Creek Drainages. The blue/violet lines show the 1981-2010 average/median. The past 5 years are displayed.



- The late April 2014 mountain snowpack in the St Vrain Creek and Big Thompson River Drainages (combined) was similar to the snowpack in late April 1984 and 1997 (but not as high as April 1986 and 1996).



The September 2013 flood was a hydrologic event (stream flooding), a geologic event (sedimentation & landslides), and a hydrogeologic event (high water table).

Many of the antecedent conditions for another flood remain:

Due to last September's rain and flooding; the risk of flooding and flash flooding is higher this year primarily in the Front Range Foothills extending into the urban corridor in Boulder, Larimer, SW Weld and extreme Nrn Jefferson Counties.

- A small amount of water could start moving large quantities of sediment in affected streams.**
- There are reduced creek and river capacities due to the increased sedimentation, rocky debris and stream bank erosion.**
- Debris flows and landslides may cause access issues and obstruct creek flows.**
- Woody debris along streams could potentially cause debris dams and subsequent flooding.**
- Altered locations and conditions of streams may impact structures and infrastructures at risk.**
- Some reservoirs in these areas are at or near capacity and will spill earlier than usual causing additional flow during the runoff and thunderstorm season.**

These 6 risks are from the Boulder Office of Emergency Management: Post-Flood Community Preparedness Guide - Flash Flood, Landslide and Debris Flow 2014 Edition at: <http://www.bouldercounty.org/doc/flood/preparednessguide2014.pdf>

Other Issues:

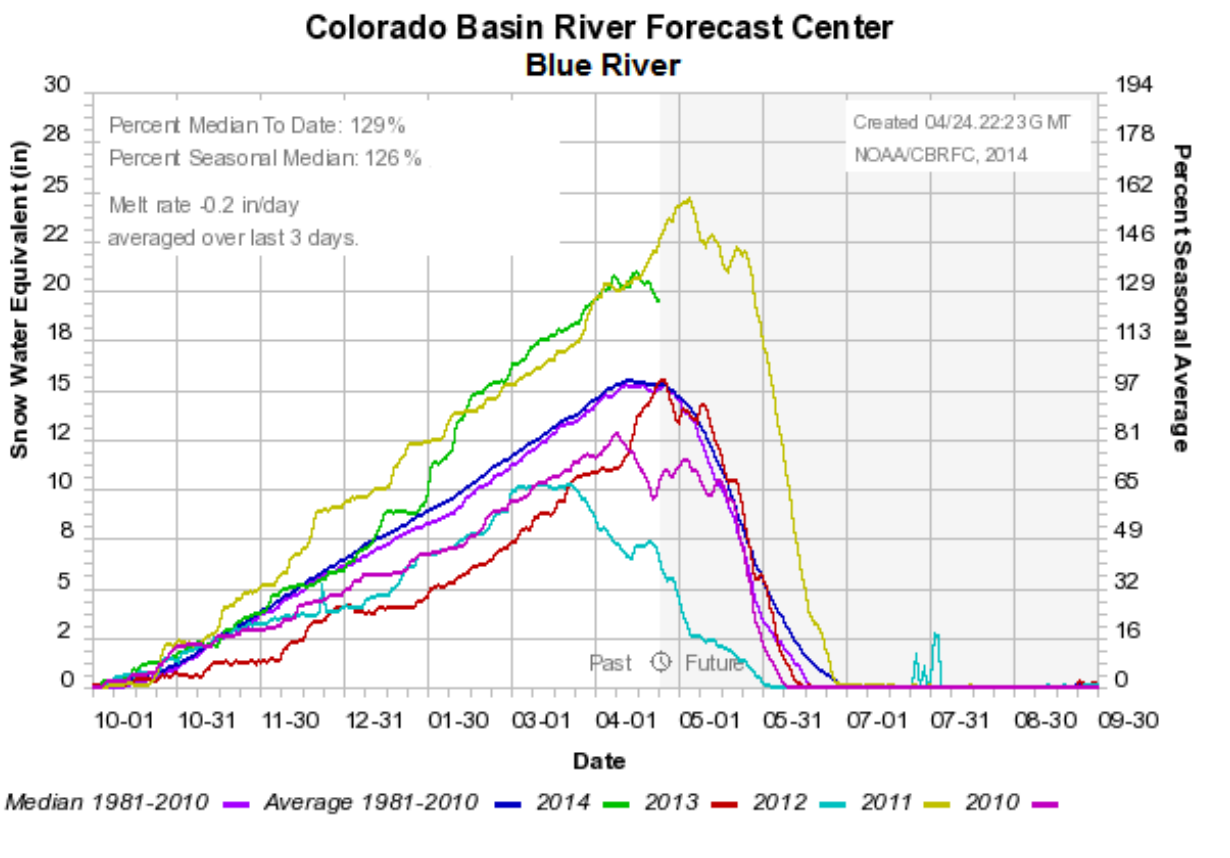
High groundwater:

- There are numerous reports of high groundwater in areas severely impacted by the September 2013 rains. If groundwater is high and soils are saturated; there will be more snowmelt runoff and higher streamflows.

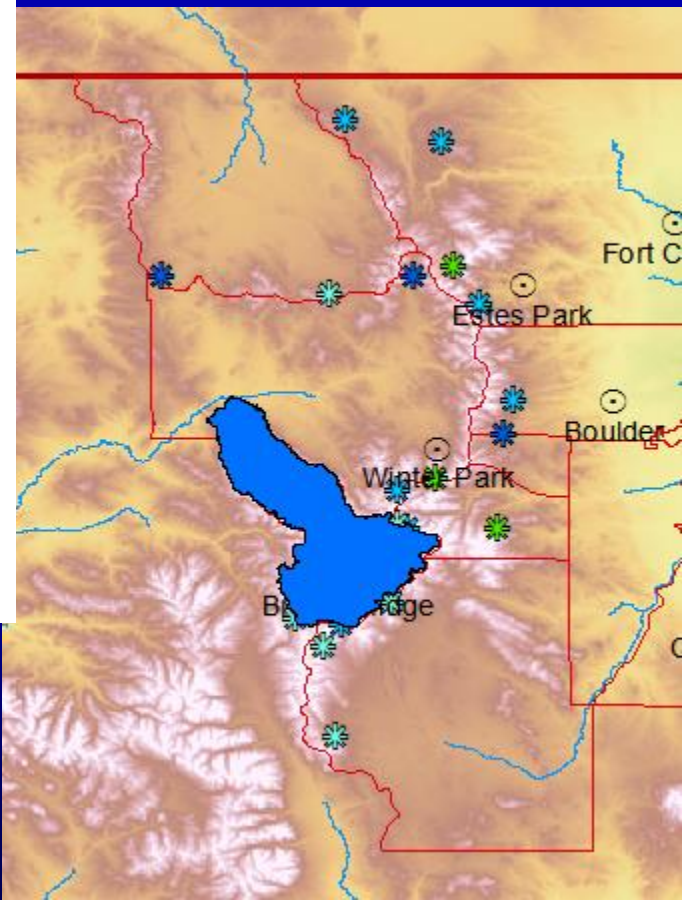
Landslides:

- The September 2013 rains destabilized hillsides and steep slopes in areas with the worst flooding. High groundwater can be a trigger for deep cut landslides. Increased landslides and rock slides will be possible this spring. However, landslides will also depend on other factors like heavy and/or prolonged rainfall, and how saturated the soils are this spring and summer.

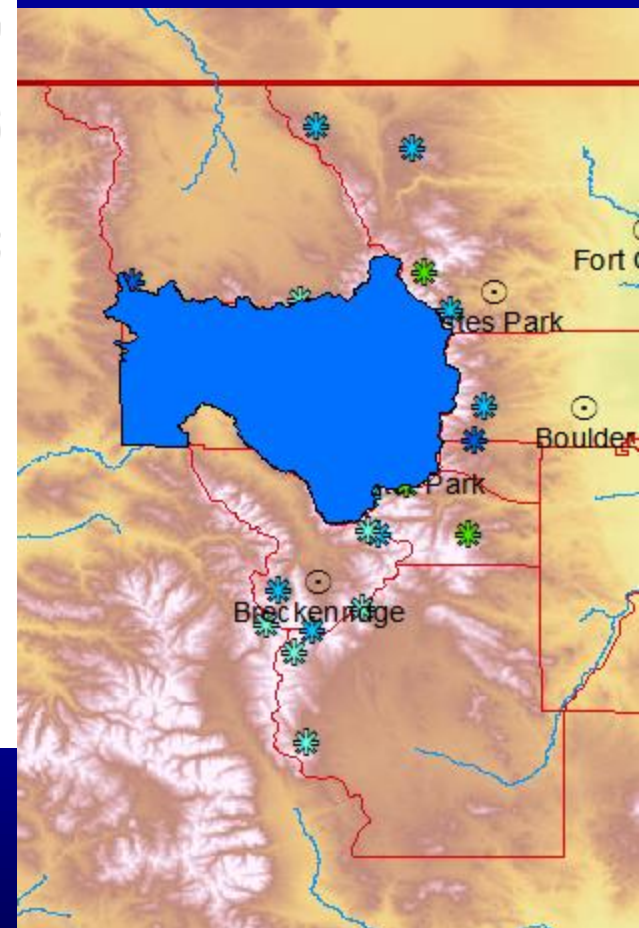
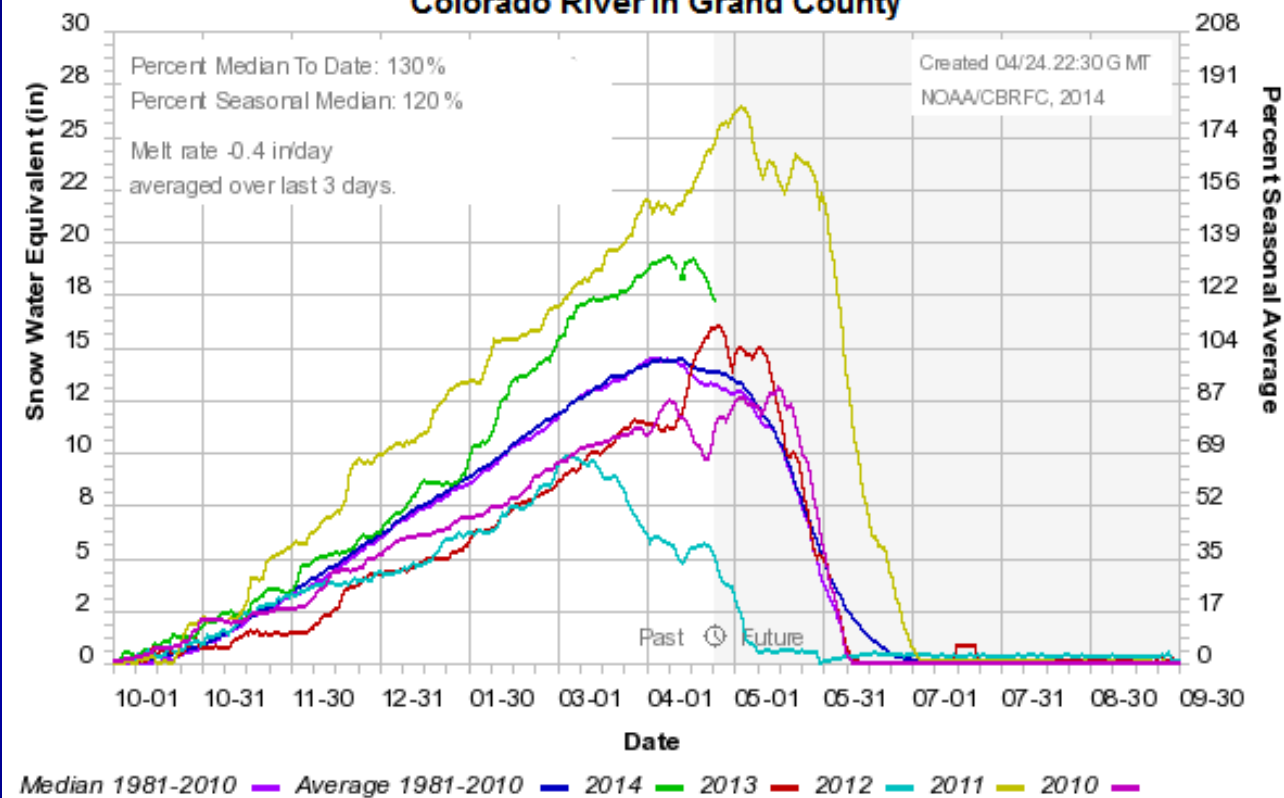
The next 7 slides show graphs the mountain snowpack time series for the past 5 years in areas of north central Colorado (graphs east of the Divide may not include data for all NRCS SNOTEL sites).



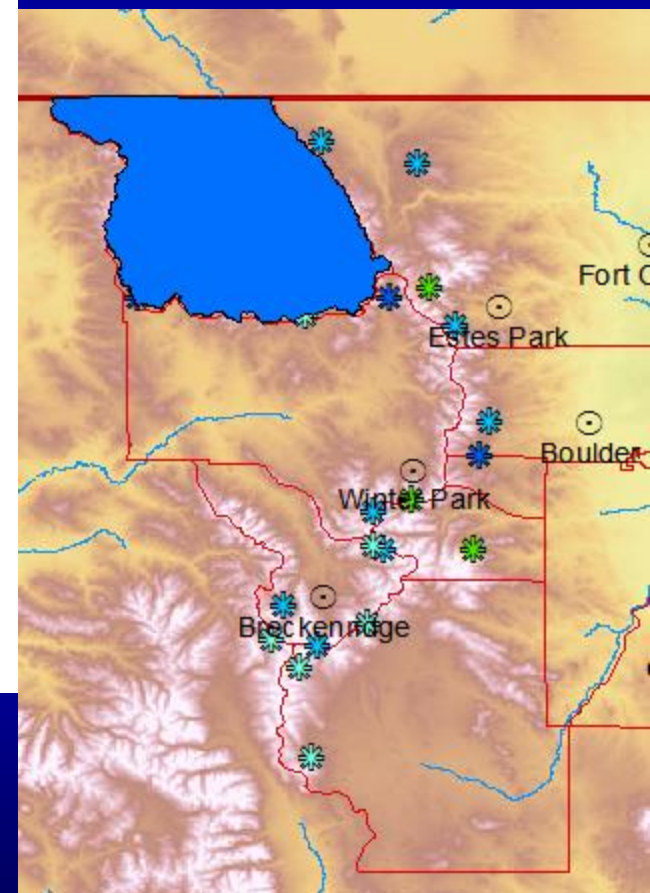
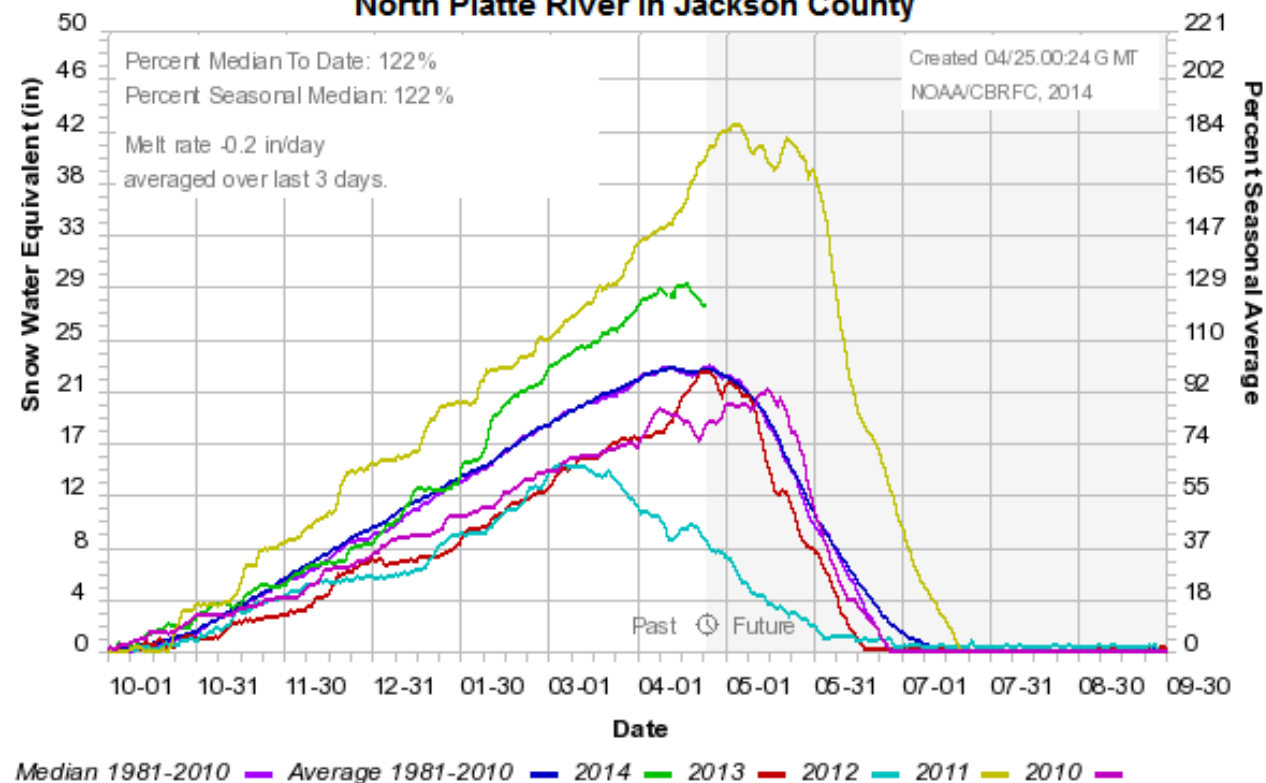
The 2014 water year (October 2013 through April 24th, 2014) is the green line on the next 5 graphs. The blue/purple smoothed lines are the average/median.



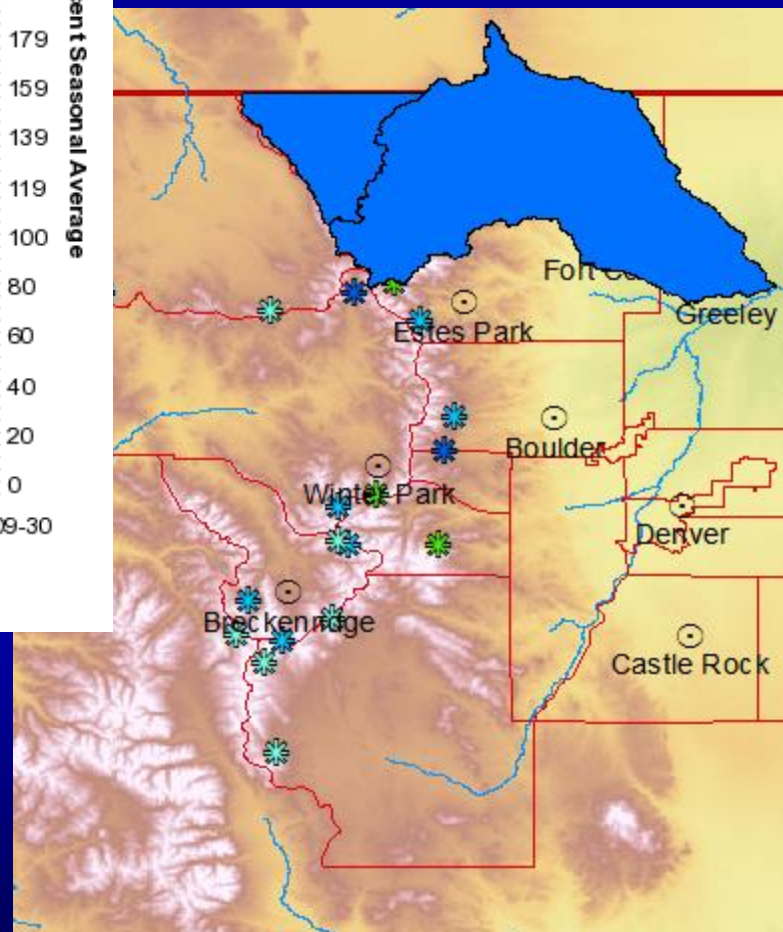
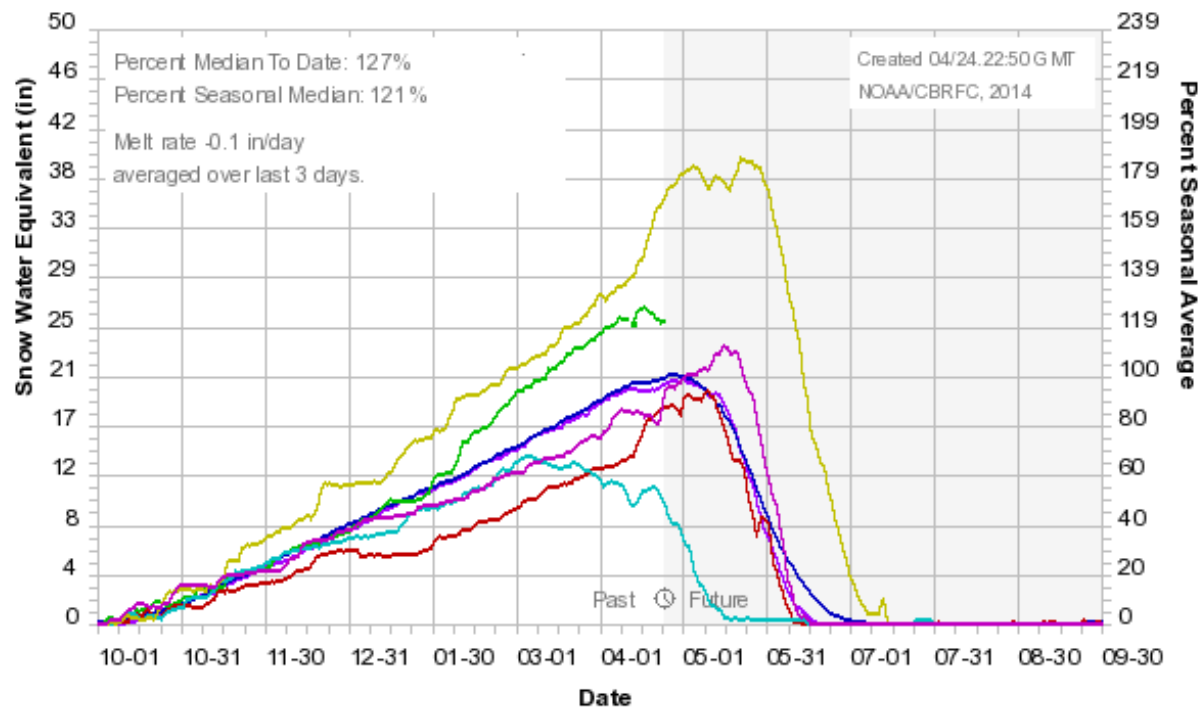
Colorado Basin River Forecast Center Colorado River in Grand County



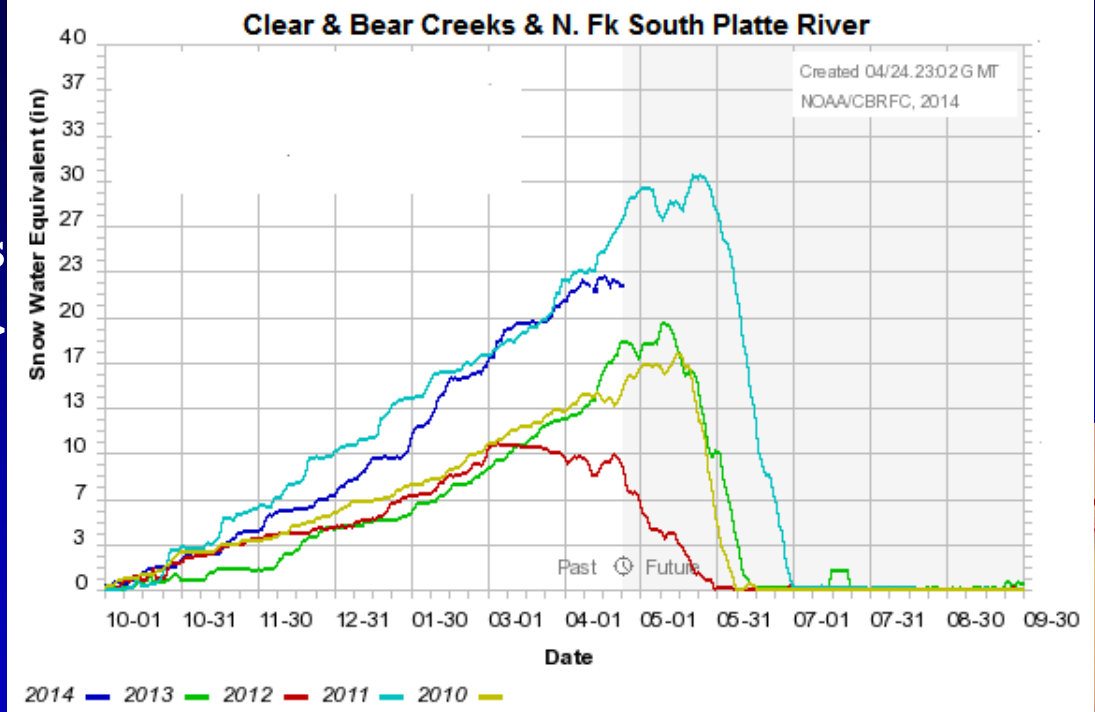
North Platte River in Jackson County



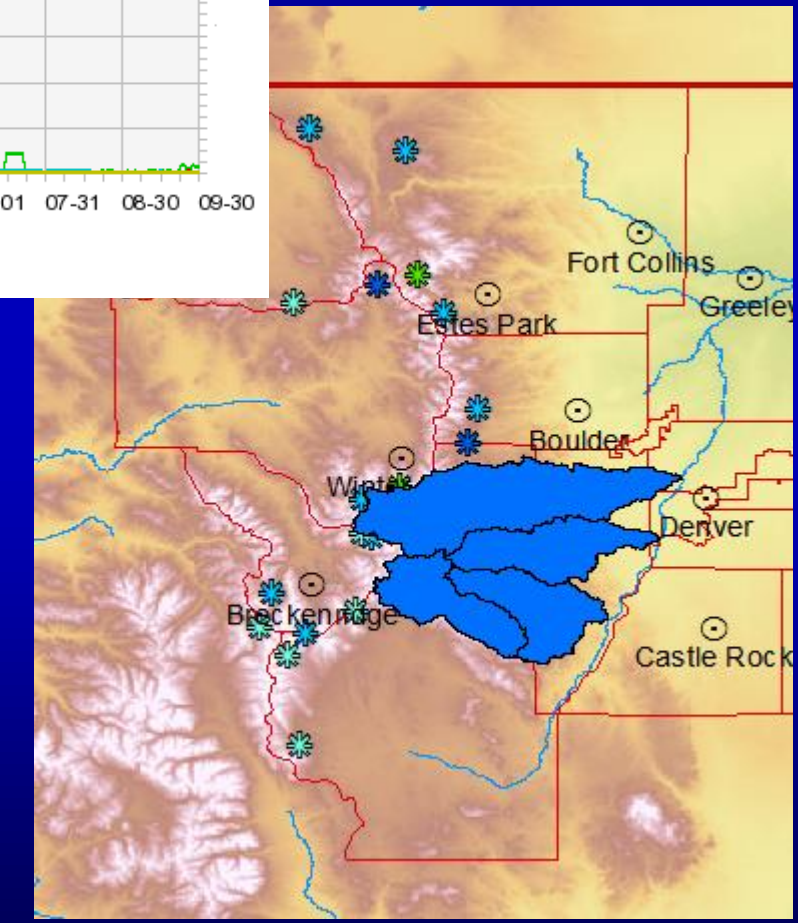
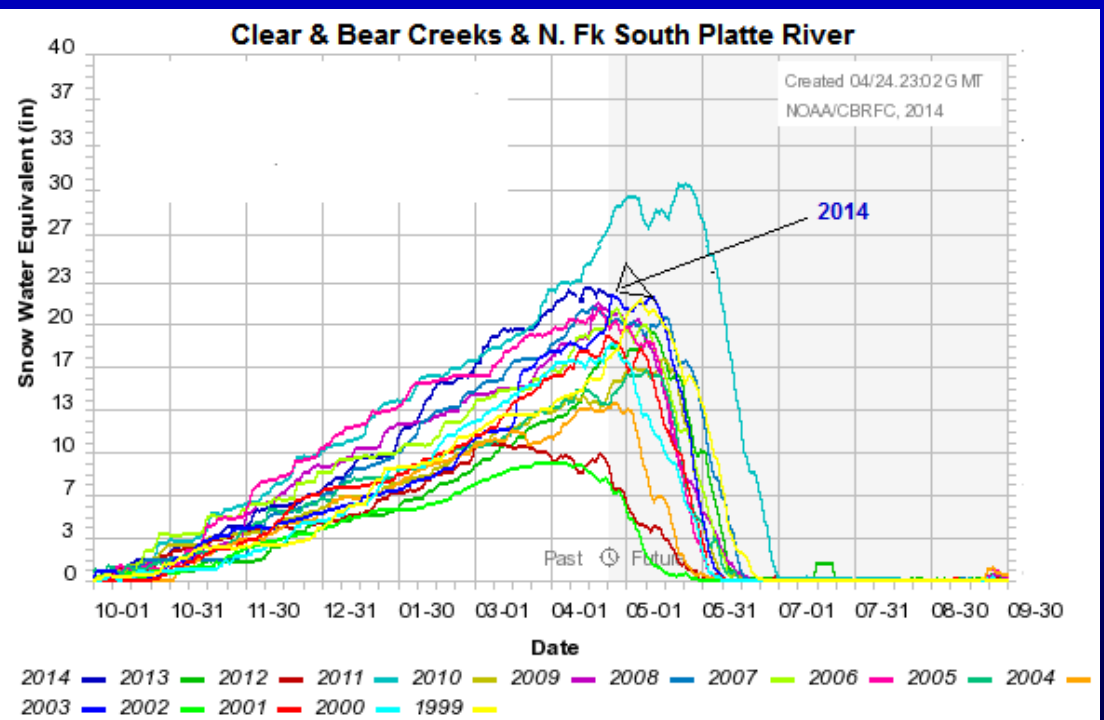
Cache la Poudre & Laramie Rivers



Past 5 years
=>

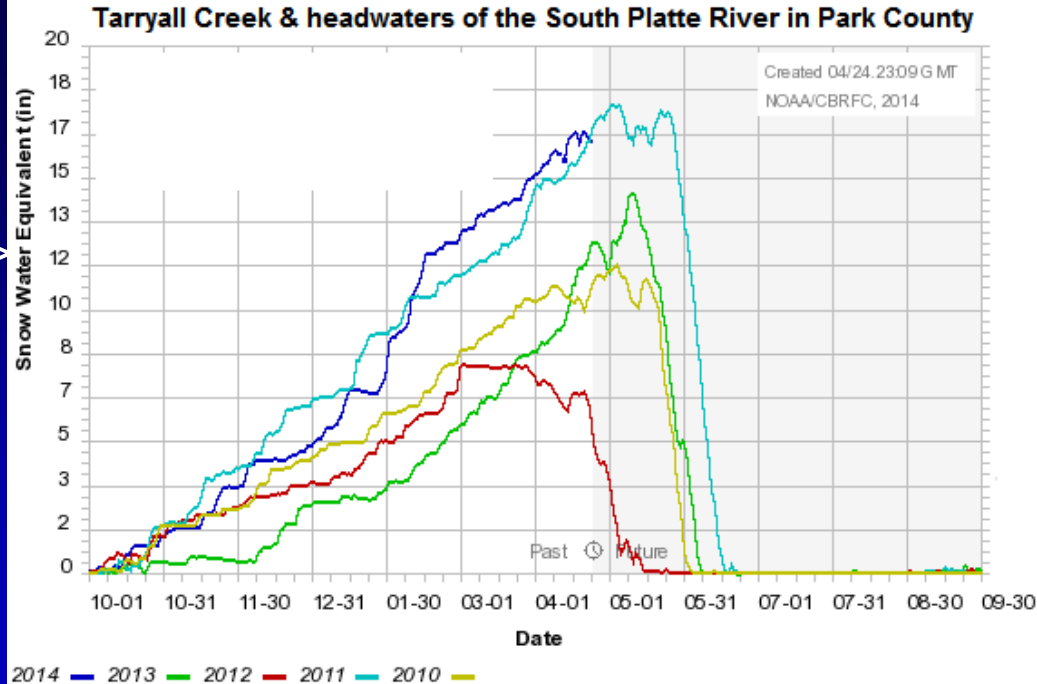


Average/median data was not available for these time series graphs.

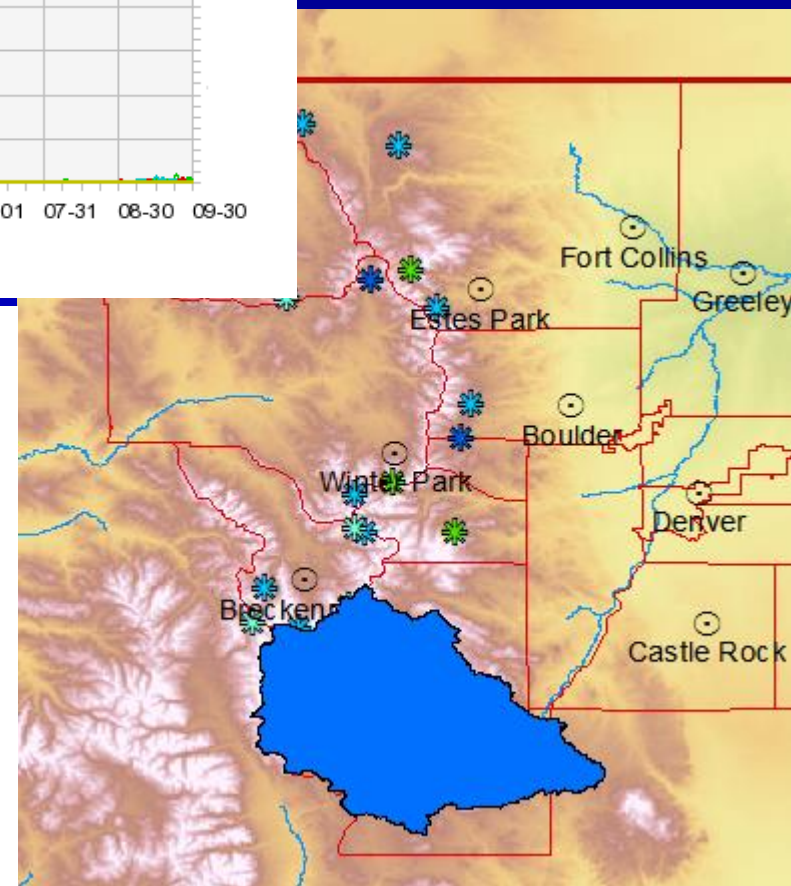
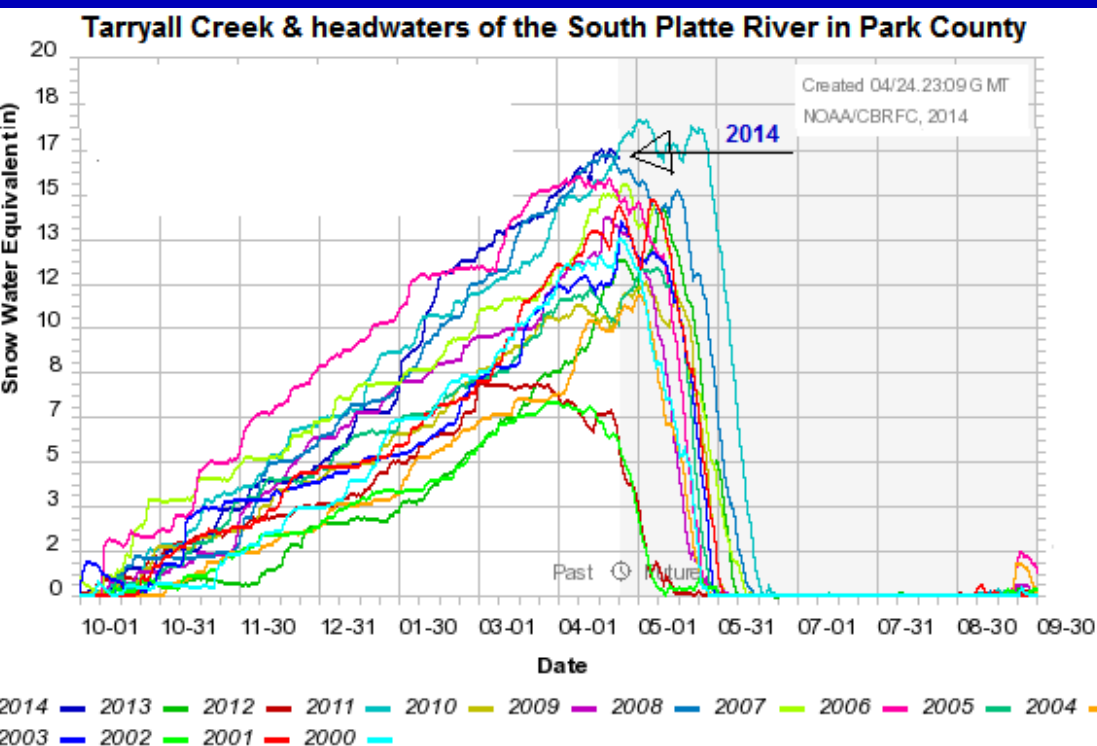


← Past 16 years

Past 5 years =>



The mountain snowpack near the Continental Divide in Park County remains high.



← Past 15 years

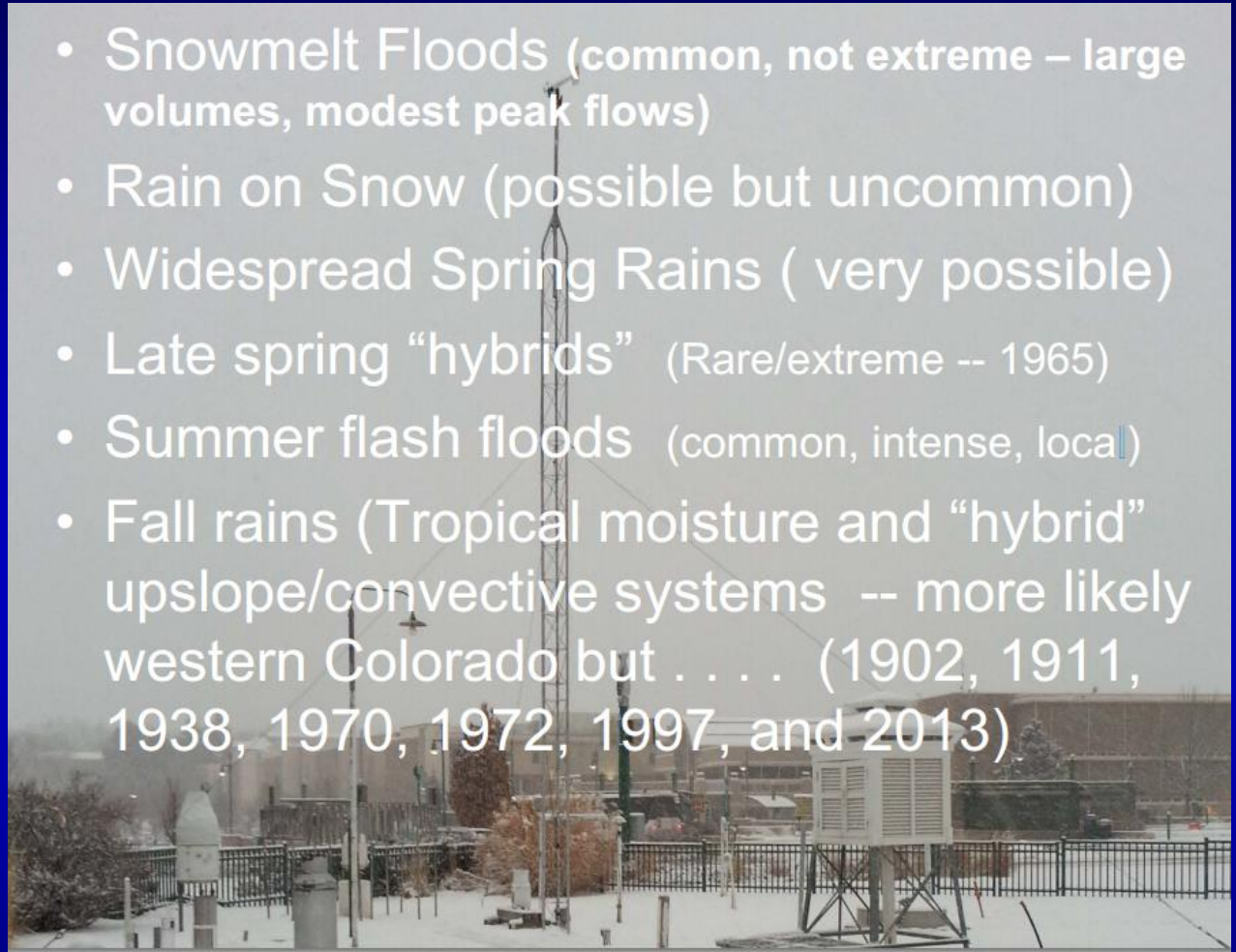
Some factors that can impact mountain snowmelt runoff:

- **Future snowfall**
- **Stream levels during the melt**
- **When and how fast the snow melts (freezing and thawing in the mountains)**
- **Future rainfall amounts and timing**
- **Whether rain (especially a warm rain) falls on the snowpack**
- **Groundwater/soil moisture**
- **Dry winds**

Spring mountain snowmelt runoff is on the increase. Precipitation is expected to be above average in the north central mountains during the next week. The 8 to 14 day outlook from May 2nd through May 8th calls for near average precipitation.

The next two slides show information from Nolan Doesken, the Colorado State Climatologist. This slide 'Colorado floods come in several flavors'

- Snowmelt Floods (common, not extreme – large volumes, modest peak flows)
- Rain on Snow (possible but uncommon)
- Widespread Spring Rains (very possible)
- Late spring “hybrids” (Rare/extreme -- 1965)
- Summer flash floods (common, intense, local)
- Fall rains (Tropical moisture and “hybrid” upslope/convective systems -- more likely western Colorado but (1902, 1911, 1938, 1970, 1972, 1997, and 2013)



- is from the Colorado Climate Center's Update and is available on the Colorado Water Conservation Board website at:
<http://cwcb.state.co.us/public-information/flood-water-availability-task-forces/Pages/main.aspx>

Nolan Doesken explained at a CWCB Flood & Water Availability Task Force Meeting:

- **There is still a month and a half of spring flood potential to come. These months (late April – early June) can swing dry or wet very, very quickly.**
- **An above-average snowpack is a cause for concern, especially in areas still recovering from September's flooding. But snowpack runoff has carved many of the waterways in the state, and those channels handled the runoff in 2011, a record year for snowpack.**
- **How much more snow falls and how quickly it melts will be key factors in whether flooding occurs.**
- **This time of year is referred to as “showtime”: many possibilities lie ahead.**

Colorado Climate Center's website : <http://climate.atmos.colostate.edu/>

Before a flood:

- Create a Communications Plan - It is important to be able to communicate with your family and friends in the event of a disaster. Whether it is having a specific person identified to contact for status updates or a safe location to meet up with family members, having a plan in place will give you peace of mind if disaster does strike.
- Prepare your Family & Pets – Planning can help you and your family evacuate faster. Also, have a plan for your pets so you won't be delayed in the danger zone. Don't wait until the last moment to gather the essentials for yourself, your family and/or your pets.
- Plan to Go to a Safe Location – Identify locations located at higher ground in case of flooding. Know more than one way to get to your safe locations on foot if necessary.
- Assemble an Emergency Kit - It is good practice to have enough food, water and medicine on hand at all times to last you at least 3 days in the case of an emergency. Water service may be interrupted or unsafe to drink and food requiring little cooking and no refrigeration may be needed if electric power is interrupted. You should also have batteries, blankets, flashlights, first aid kit, rubber boots, rubber gloves, and a NOAA Weather Radio or other battery operated radio easily available.
- Prepare Your Home - If you have access to sandbags or other materials, you may be able to use them to protect your home from flood waters if you have sufficient time to do so. Filling sandbags can take more time than you may think.